

The Relation of Residential Segregation to All-Cause Mortality: A Study in Black and White

ABSTRACT

Objectives. This study investigated the influence of an aggregate measure of the social environment on racial differences in all-cause mortality.

Methods. Data from the National Longitudinal Mortality Study were analyzed.

Results. After adjustment for family income, age-adjusted mortality risk increased with increasing minority residential segregation among Blacks aged 25 to 44 years and non-Blacks aged 45 to 64 years. In most age/race/gender groups, the highest and lowest mortality risks occurred in the highest and lowest categories of residential segregation, respectively.

Conclusions. These results suggest that minority residential segregation may influence mortality risk and underscore the traditional emphasis on the social underpinnings of disease and death. (*Am J Public Health*. 2000;90: 615–617)

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Racial differences in all-cause mortality have been well documented.^{1–3} Investigations into causes of observed disparities frequently focus on characteristics of individuals, emphasizing the role of specific lifestyle behaviors, health care access, socioeconomic status (SES), and social class.^{4,5} Recent research suggests a potential etiologic influence of aggregate measures of the socioenvironmental situation of individuals on mortality^{4,6,7} and other health indicators.^{8–10} Within this context, factors such as availability of local health care and other resources, disempowerment, economic disinvestment, concentration of poverty, and local social and cultural norms are thought to affect individual health either indirectly, through consequent personal health behaviors, or directly, through increased exposure to conditions deleterious to health.^{4,11,12}

Geographic areas characterized by poverty, disempowerment, economic disinvestment, and limited availability of health care and other resources (i.e., impoverished areas) often have high percentages of minority residents.¹³ Data from ecologic studies suggest that minority residential segregation is positively associated with all-cause mortality, after adjustment for poverty;¹⁴ however, it is not possible to extrapolate these ecologic findings to individuals. Thus, it is unclear whether similar associations exist at the individual level; that is, do individuals who live in segregated areas have higher age-adjusted mortality risks independent of their individual SES?

Using data from the National Longitudinal Mortality Study, we examined the influence of minority residential segregation (an aggregate measure) on racial differences in mortality. We hypothesized that this aggregate measure would affect mortality independently of individual-level measures of SES.

Methods

The National Longitudinal Mortality Study is a large national database of the US noninstitutionalized population assembled from Bureau of Labor Statistics Current Population Surveys collected between February 1978 and March 1985. Mortality follow-up involved matching each survey in the National Longitudinal Mortality Study to the national death index for the years 1979 through 1989.

Percentage of Blacks in a given census tract is the indicator of minority residential segregation; a high percentage of Blacks per tract population corresponds to greater minority segregation. Other racial/ethnic minorities may be present within census tracts; however, Blacks may experience higher levels of residential segregation and more hypersegregation (i.e., segregation in socioenvironmental dimensions such as recreational activities, church, and other social gatherings).¹⁵

Census tract percentages of Blacks were linked to the National Longitudinal Mortality Study database through information provided in the 1980 census (file STF3A).⁶ Race was dichotomized as Black and non-Black according to self-report. Family income (in 7 categories: less than \$5000, \$5000–\$10 000,

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\$10 000–\$15 000, \$15 000–\$20 000, \$20 000–\$25 000, \$25 000–\$50 000, and more than \$50 000) was chosen as the measure of an individual's SES. In the Current Population Survey, family income is the reported total combined income of all members of the respondent's family residing in the household; this value was adjusted to 1980 dollars via the consumer price index.

Analyses for this study were conducted separately for specific race, sex, and age categories. The indirect method of standardization was used in calculating age-adjusted death rates by segregation category for each age, race, and sex group. A series of Cox proportional hazard models was used to examine the age-adjusted relationships between all-cause mortality, family income, and residential segregation. Risk ratios, when adjusted for individual income, reflect the unique contribution of segregation to mortality.

Results

A total of 239 186 individuals who reported their annual family income and specified their race as either Black or non-Black were linked with census tract information. Approximately 54% of these individuals were female, and 89% were non-Black. Most Blacks (54%) lived in areas where at least 70% of the residents were Black, while most non-Blacks (86%) lived in areas with predominantly non-Black residents (i.e., fewer than 10% Black residents); this pattern was evident for all sex and age groups. Non-Blacks were 5 times as likely as Blacks to report annual family incomes of more than \$25 000 (37% vs 7%).

The number of deaths identified during the national death index follow-up (ranging from 4 to 11 years) was 12367. Table 1 presents age-adjusted mortality rates by race, sex, age group, and degree of minority residential segregation. Mortality increased with increasing minority residential segregation among Black men aged 25 to 44 years, non-Black men and women aged 45 to 64 years, and Black women 65 years and older. For most groups, the highest and lowest mortality rates were observed in the highest and lowest categories of residential segregation, respectively.

Proportional hazards model estimates of all-cause mortality (and 95% confidence intervals) are presented in Table 2. Black men aged 25 to 44 years who lived in areas of highest minority residential segregation had almost 3 times the mortality risk of those living in the areas of lowest minority residential segregation. Among Black women in the

TABLE 1—Mortality Rates per 10000 Person-Years, by Race, Sex, Age Group, and Degree of Residential Segregation: National Longitudinal Mortality Study, 1978–1985

Age and Proportion Black in Tract	Mortality Rate (95% Confidence Interval)			
	Black Men	Black Women	Non-Black Men	Non-Black Women
25–44 years				
≤0.10	11 (4, 24)	11 (4, 23)	18 (16, 20)	8 (7, 9)
0.10–0.30	31 (17, 50)	9 (3, 20)	22 (17, 27)	13 (9, 18)
0.30–0.70	36 (25, 50)	21 (14, 31)	20 (13, 30)	12 (7, 19)
0.70–1.00	49 (40, 61)	23 (17, 29)	26 (9, 56)	14 (4, 36)
45–64 years				
≤0.10	136 (99, 181)	89 (61, 125)	94 (90, 98)	54 (51, 56)
0.10–0.30	158 (118, 205)	107 (79, 142)	111 (98, 124)	62 (53, 72)
0.31–0.70	149 (122, 180)	99 (81, 120)	127 (107, 150)	74 (60, 90)
0.70–1.00	166 (148, 186)	100 (89, 113)	138 (95, 194)	79 (51, 118)
≥65 years				
≤0.10	561 (440, 702)	343 (256, 446)	512 (500, 523)	346 (338, 354)
0.10–0.30	530 (431, 642)	360 (294, 435)	609 (570, 650)	380 (354, 406)
0.30–0.70	585 (507, 670)	369 (320, 424)	598 (543, 657)	348 (316, 381)
0.70–1.00	599 (551, 650)	372 (341, 403)	524 (430, 631)	391 (325, 464)

Note. Mortality rates were calculated via the indirect method of age adjustment.

same age group, the risk was nearly twice as great. Adjustment for age and family income reduced but did not remove this association.

Among non-Blacks, residential segregation exerted the greatest influence in the 45- to 64-year age group. Women living in areas with the highest minority residential segregation evidenced a 60% greater risk of mortality than those living in areas with the lowest minority residential segregation. Among men, the risk was increased by 30%. There was a pattern of moderately increased mortality with increasing residential segregation among men and women aged 25 to 44 years.

The likelihood ratio statistics testing the joint significance of all explanatory variables in the multivariate models (data not shown) revealed that age, proportion of Blacks in census tract, and family income were each significant correlates of all-cause mortality among Blacks aged 25 to 44 years and among all non-Black age groups. Age was the only significant correlate of mortality among Blacks 65 years or older, while both age and family income were important among Blacks aged 45 to 64 years.

Discussion

Mortality differences between Blacks and Whites are often thought to reflect differences in individual behaviors, resources, and access to care. Sorlie and colleagues¹⁶ examined Black–White mortality differences in the National Longitudinal Mortality Study and found that adjustment for individual income accounted for less than one third of

the excess risk among Blacks. They and others have hypothesized that segregation and socioenvironmental influences (e.g., neighborhood poverty rate, community SES) may be an additional source of risk affecting disadvantaged groups.¹³

Our study extends the literature by simultaneously investigating individual and aggregate SES risk for racial differences in mortality. We found that, independent of family income, minority residential segregation may be related to mortality, especially among younger Black men and women (i.e., those aged 25 to 44 years) and middle-aged non-Blacks (i.e., those aged 45 to 64 years). An association between residential segregation and mortality among young adult Black men was also reported in an ecologic study conducted by Polednak.¹⁷ The finding of similar relationships in Blacks and non-Blacks also supports the hypothesis that socioenvironmental exposures are related to mortality risk over and above the individual demographic characteristics of sex, race, or level of family income.

Our measure, percentage of Black residents in a given census tract, is only one of several contextual variables that may be important to study. Other ecologic measures that have been used include the index of dissimilarity, metropolitanization, and income inequality and household composition.^{7,18,19} Despite methodological differences, there is consistency in findings between this and other studies regarding the association between segregation and mortality.

Another influence unaccounted for in our study was the potential for selection

TABLE 2—Relative Risk for All-Cause Mortality, by Residential Segregation, Age Group, Race, and Sex: National Longitudinal Mortality Study, 1978–1985

Age and Proportion Black in Tract	Model 1 ^a		Model 2 ^b	
	Men, RR (95% CI)	Women, RR (95% CI)	Men, RR (95% CI)	Women, RR (95% CI)
Blacks				
25–44 years				
≤0.10	Reference	Reference	Reference	Reference
0.10–0.30	1.7 (0.8, 3.5)	1.0 (0.4, 2.4)	1.6 (0.8, 3.4)	0.9 (0.3, 2.2)
0.30–0.70	2.2 (1.2, 4.2)*	2.4 (1.1, 5.0)*	2.2 (1.2, 4.1)*	2.1 (1.0, 4.4)*
0.70–1.00	2.8 (1.6, 5.2)*	2.1 (1.0, 4.3)*	2.7 (1.5, 4.9)*	1.7 (0.8, 3.6)
45–64 years				
≤0.10	Reference	Reference	Reference	Reference
0.10–0.30	1.0 (0.7, 1.5)	1.1 (0.8, 1.7)	1.0 (0.7, 1.4)	1.1 (0.7, 1.6)
0.30–0.70	1.0 (0.7, 1.4)	1.1 (0.8, 1.6)	0.9 (0.7, 1.3)	1.0 (0.7, 1.5)
0.70–1.00	1.0 (0.8, 1.4)	1.1 (0.8, 1.5)	1.0 (0.8, 1.4)	1.0 (0.7, 1.4)
65+ years				
≤0.10	Reference	Reference	Reference	Reference
0.10–0.30	1.1 (0.8, 1.5)	1.1 (0.8, 1.5)	1.1 (0.8, 1.5)	1.0 (0.7, 1.5)
0.30–0.70	1.2 (0.8, 1.6)	1.0 (0.7, 1.4)	1.2 (0.8, 1.6)	1.0 (0.7, 1.4)
0.70–1.00	1.2 (0.9, 1.6)	1.1 (0.8, 1.4)	1.2 (0.9, 1.6)	1.0 (0.8, 1.4)
Non-Blacks				
25–44 years				
≤0.10	Reference	Reference	Reference	Reference
0.10–0.30	1.3 (1.1, 1.6)*	1.3 (1.0, 1.8)	1.2 (1.0, 1.5)*	1.2 (0.9, 1.6)
0.30–0.70	1.3 (1.0, 1.8)*	1.8 (1.2, 2.4)*	1.1 (0.8, 1.6)	1.5 (1.0, 2.1)*
0.70–1.00	1.2 (0.6, 2.4)	1.6 (0.7, 3.6)	1.0 (0.5, 2.0)	1.3 (0.6, 2.8)
45–64 years				
≤0.10	Reference	Reference	Reference	Reference
0.10–0.30	1.2 (1.1, 1.3)*	1.2 (1.0, 1.3)*	1.1 (1.0, 1.2)	1.1 (1.0, 1.3)*
0.30–0.70	1.2 (1.1, 1.4)*	1.3 (1.1, 1.6)*	1.1 (1.0, 1.3)	1.2 (1.0, 1.4)*
0.70–1.00	1.4 (1.1, 1.9)*	1.7 (1.2, 2.3)*	1.3 (1.0, 1.7)	1.6 (1.2, 2.1)*
65+ years				
≤0.10	Reference	Reference	Reference	Reference
0.10–0.30	1.2 (1.1, 1.3)*	1.1 (1.0, 1.2)*	1.2 (1.1, 1.2)*	1.1 (1.0, 1.2)*
0.30–0.70	1.2 (1.0, 1.3)*	1.0 (0.9, 1.1)	1.1 (1.0, 1.3)*	1.0 (0.9, 1.1)
0.70–1.00	1.0 (0.8, 1.2)	1.0 (0.8, 1.2)	0.9 (0.8, 1.1)	1.0 (0.8, 1.2)

Note. Model 1 was adjusted for age only; model 2 was adjusted for age and family income.

RR=relative risk; CI=confidence interval.

* $P < .05$.

through in-migration and out-migration. It is possible that less healthy individuals were less likely than healthy individuals to move from highly segregated areas. This could occur, for example, when health predicts income and is closely linked to affordable housing. However, such an effect, rather than diminishing the results of this study, would begin to explain how individual risks for death become clustered by area and economics. These and other hypotheses should be pursued.

Our findings should be interpreted in light of the study's limitations, such as the exclusion of rural areas that are not part of census tracts and the lack of information on prevalent disease and risk factor status. Our results underscore the traditional epidemiologic emphasis on the social underpinnings

of disease and illness, which cannot be gleaned solely at the individual level. In addition to measures of segregation, other measures that capture community vitality are needed to characterize the health profile of an area. □

Contributors

S. A. Jackson and R. T. Anderson contributed to the paper's conception. N. J. Johnson contributed to data analysis. All of the authors contributed to data interpretation and to the writing of the paper, and they take responsibility for its content.

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